

Stellar Structure & Evolution, Fall 2002

Problem Set 3

Due date: Thursday, 7 November 2002 *at 10:00 a.m.*

1. Color-magnitude diagrams

- (a) Explain, *in your own words*, the technique of main-sequence fitting.
- (b) Estimate the distance to the globular cluster M3 by comparing its observed color-magnitude diagram to the composite diagram for Population I clusters (Figures 13.27 and 13.29, respectively, in Carroll & Ostlie).
- (c) The actual distance to M3 is estimated to be 9.7 kpc. Compare this with your answer in (b) and explain the discrepancy.
- (d) Estimate the age of M3.
- (e) How can the H-R diagram be used to determine the age of a single field star?

2. Life of the Sun

First read through the textbooks and piece together the different stages in the evolution of a star with one solar mass.

Then use Figures 8.1 and 8.19 in Prialnik to describe the important evolutionary stages for a $1 M_{\odot}$ star *without* referring directly to the text from the book(s). Discuss the physical processes that cause the star to change its position in the H-R diagrams.

NOTE: You may discuss in general with other students but please try to put together and write down this “life story of the Sun” on your own.

3. Degenerate matter

- (a) What exactly is a degenerate gas?
- (b) Explain the physical reasons for the existence of the Chandrasekhar limit.
- (c) If our Moon were as dense as a neutron star, what would its diameter be?